Idiopathic intracranial hypertension in men

B.B. Bruce, MD
S. Kedar, MD
G.P. Van Stavern, MD
D. Monaghan, BS
M.D. Acierno, MD
R.A. Braswell, MD
P. Preechawat, MD
J.J. Corbett, MD
N.J. Newman, MD
V. Biousse, MD

Address correspondence and reprints to Dr. Valérie Biousse, Neuro-ophthalmology Unit, Emory Eye Center, 1365-B Clifton Rd., NE, Atlanta, GA 30322
vbiouss@emory.edu

ABSTRACT

Objective: To compare the characteristics of idiopathic intracranial hypertension (IIH) in men vs women in a multicenter study.

Methods: Medical records of all consecutive patients with definite IIH seen at three university hospitals were reviewed. Demographics, associated factors, and visual function at presentation and follow-up were collected. Patients were divided into two groups based on sex for statistical comparisons.

Results: We included 721 consecutive patients, including 66 men (9%) and 655 women (91%). Men were more likely to have sleep apnea (24% vs 4%, $p < 0.001$) and were older (37 vs 28 years, $p = 0.02$). As their first symptom of IIH, men were less likely to report headache (55% vs 75%, $p < 0.001$) but more likely to report visual disturbances (35% vs 20%, $p = 0.005$). Men continued to have less headache (79% vs 89%, $p = 0.01$) at initial neuro-ophthalmologic assessment. Visual acuity and visual fields at presentation and last follow-up were significantly worse among men. The relative risk of severe visual loss for men compared with women was 2.1 (95% CI 1.4–3.3, $p = 0.002$) for at least one eye and 2.1 (95% CI 1.1–3.7, $p = 0.03$) for both eyes. Logistic regression supported sex as an independent risk factor for severe visual loss.

Conclusion: Men with idiopathic intracranial hypertension (IIH) are twice as likely as women to develop severe visual loss. Men and women have different symptom profiles, which could represent differences in symptom expression or symptom thresholds between the sexes. Men with IIH likely need to be followed more closely regarding visual function because they may not reliably experience or report other symptoms of increased intracranial pressure. *Neurology*® **2009;72:304–309**

GLOSSARY

BMI = body mass index; **HVF MD** = Humphrey visual field mean deviation; **IIH** = idiopathic intracranial hypertension; **MR** = magnetic resonance; **VA** = visual acuity.

Although idiopathic intracranial hypertension (IIH) typically occurs in young, obese women, it does occur in men. Prognosis in IIH is variable, with severe visual loss occurring in up to 10% of patients.[1] Although few series have specifically evaluated sex differences in IIH, it has been suggested that men with IIH may have more severe visual outcomes.[2,3] The purpose of this study was to compare the characteristics of IIH in men vs women.

METHODS The study was approved by each participating university's institutional review board. All consecutive charts for patients given the diagnosis code of IIH or disk edema seen by the neuro-ophthalmology services at Emory University (1989–2007), University of Mississippi (1989–2007), and Wayne State University (2001–2007) were identified and reviewed. Only patients with definite IIH diagnosed according to the modified Dandy criteria were included: 1) signs and symptoms of increased intracranial

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From the Departments of Ophthalmology (B.B.B., N.J.N., V.B.), Neurology (N.J.N., V.B.), and Neurological Surgery (N.J.N.), Emory University, Atlanta, GA; Departments of Neurology (S.K., D.M., J.J.C.) and Ophthalmology (J.J.C.), University of Mississippi, Jackson, MS; Department of Ophthalmology (G.P.V.S.), Wayne State University, Detroit, MI; Department of Ophthalmology (M.D.A.), Louisiana State University, New Orleans, LA; Department of Ophthalmology (R.A.B.), University of Alabama, Birmingham, AL; and Department of Ophthalmology (P.P.), Ramathibodi Hospital, Mahidol University, Thailand.
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pressure, 2) no localizing signs except abducens nerve palsy, 3) CSF opening pressure ≥ 25 cm with normal CSF composition, and 4) normal neuroimaging (ruling out venous sinus thrombosis).[4]

Although the study was a retrospective chart review, all patients had been evaluated in a standardized fashion by experienced neuro-ophthalmologists, including documentation of body habitus, blood pressure, and complete neuro-ophthalmic examination with formal visual fields, fundus photography, review of neuroimaging tests, and recording of factors associated with IIH. Demographic information regarding age, sex, and race were collected. Race was assessed by the judgment of the examiner based on patient appearance. Medication use (current and recent), the presence or absence of several associated factors (recent weight gain, known sleep apnea, anemia [hemoglobin <12 g/dL], systemic hypertension, endocrine disorders, and pregnancy), symptoms (headache, tinnitus, diplopia, and transient visual obscuration), Snellen visual acuity, formal visual fields (static perimetry using a Humphrey automated perimeter and kinetic perimetry using a Goldmann perimeter), and dilated ophthalmoscopic appearance were recorded. Medications considered possibly contributing included vitamin A preparations, minocycline, cyclosporine, doxycycline, tetracycline, and recent discontinuation of steroids. The contributing medications were grouped by their presence or absence in each patient for analysis. Although not all patients had a formal assessment of their weight and height, for those who did, body mass index was calculated for use in statistical analyses according to the World Health Organization body mass index (BMI) guidelines.[5] Prediagnosis duration of symptoms, CSF opening pressure, height, weight, medical treatments, surgical treatments, follow-up duration, and visual outcome were also recorded.

Snellen visual acuity was converted to logMAR visual acuity for analysis. Formal visual fields were systematically reviewed for all patients. All visual field defects, whether obtained with static or kinetic perimetry, were graded on a 1 to 4 scale as 1) normal, 2) enlargement of the blind spot, 3) nasal or temporal defect, or 4) diffusely constricted. In addition, mean deviations were recorded for those patients who underwent static automated perimetry. Papilledema was graded with the Frisén staging scheme[6] by systematic review of fundus photography: stage 0 defines a normal optic nerve head, and stage 5 defines severe papilledema. Severe visual loss in an eye was defined by the US criteria for legal blindness (best corrected visual acuity less than or equal to 20/200 or total central visual field less than 20 degrees) and assessed at the last available visit. Patients were divided into two groups based on sex for statistical comparisons.

All patients had definite IIH by the modified Dandy criteria, but two aspects of our population merit further mention. First, although all patients underwent a lumbar puncture that documented elevation of CSF opening pressure, the specific value was sometimes unavailable. Second, clinically appropriate neuroimaging was performed on all patients to rule out cerebral venous thrombosis. However, because the patient population is representative of an actual clinical practice, there were occasionally practical limitations to obtaining ideal imaging studies, such as body habitus preventing entry into imaging gantries and changes in the clinical usage of MRI and magnetic resonance (MR) venography over the study period.[7] MRIs were all reviewed at the time of diagnosis, and MR venography or CT venography was obtained when there was a question regarding possible cerebral venous thrombosis. Those patients who could not have MRI had head CT with contrast, often accompanied by CT venography.

Statistical analysis was performed with R: a language and environment for statistical computing (R Foundation for Statistical Computing, http://www.R-project.org). Continuous and ordinal variables were compared between groups using the Mann–Whitney *U* test. The Pearson χ^2 test with the Yates continuity correction or the Fisher exact test, as appropriate, was used to compare the frequency distribution of categorical variables between groups. These tests were two tailed, and significance was set at 5%. Univariate analyses for sex vs other factors were undertaken on the entire population and on patients older than 12 years of age at diagnosis. A multivariate logistic regression analysis was performed with the outcome of severe visual loss in at least one eye with sex, age, diagnosis of sleep apnea, and headache as first sign of IIH included as predictors.

RESULTS We included 721 patients in the study. Emory University contributed 486 patients (67%), University of Mississippi contributed 193 (27%), and Wayne State University contributed 42 (6%). There were 66 (9%) men and 655 (91%) women.

The table details the differences between men and women with IIH. Men were more likely than women to have a diagnosis of sleep apnea (24% vs 4%, $p < 0.001$). Men reported less headache than women as the initial symptom of IIH (55% vs 75%, $p < 0.001$) and at the first neuro-ophthalmology evaluation (79% vs 89%, $p = 0.01$). Men were more likely than women to report visual changes as their first symptom of IIH (35% vs 20%, $p = 0.004$). Tinnitus was less frequently reported by men at first neuro-ophthalmology evaluation (26% vs 38%, $p = 0.05$).

MRI was obtained in 92% of all included patients. Those who were unable to undergo MRI had a head CT with contrast, often with CT venography. MR venography or CT venography was obtained in 34% of women and 26% of men ($p = 0.17$).

Men had significantly worse visual acuities and visual fields than women, at both initial and final evaluations (table). The relative risk of severe visual loss for men vs women was 2.1 (95% CI 1.4–3.3, $p = 0.002$) for one eye and 2.1 (95% CI 1.1–3.7, $p = 0.03$) for both eyes.

Subset analyses were performed on all patients older than 12 years of age at diagnosis, consisting of 53 men (8%) and 616 women (92%). All differences reported above remained significant within this subset, but men were additionally found to be older than women at diagnosis (37 vs 28 years, $p = 0.02$).

Male sex remained an independent risk factor for severe visual loss in at least one eye when adjusted for age, diagnosis of sleep apnea, and headache as first sign of IIH (adjusted odds ratio 2.5, $p = 0.004$ vs unadjusted odds ratio 2.6, $p = 0.001$).

DISCUSSION We present the largest series of IIH patients reported in the literature. Our study found a 9% prevalence of IIH in men, thereby confirming that IIH in men is rare. The prevalence of IIH in men has been estimated to be between 6% and 50%

Table Demographics, risk factors, CSF opening pressure, treatment, symptoms, and examination of men and women with idiopathic intracranial hypertension

	Women, n = 655		Men, n = 66		
	n or median	% or range	n or median	% or range	*p* Value
Demographics/risk factors					
Age, y (n = 719)	28	(2–67)	28	(2–65)	0.93
Black	311	(48%)	28	(42%)	0.41
Contributing medications	59	(9%)	2	(3%)	0.11
Sleep apnea	25	(4%)	16	(24%)	<0.001
Anemia	56	(9%)	3	(5%)	0.35
Endocrine disorder	83	(13%)	9	(14%)	0.82
Hypertension	140	(21%)	16	(24%)	0.59
Prediagnosis duration of symptoms, wk (n = 635)	6	(0–500)	4	(0–100)	0.10
Follow-up duration, wk (n = 678)	16	(0–592)	12.5	(0–168)	0.21
CSF opening pressure, cm CSF (n = 580)	37	(25–75)	37	(25–60)	0.67
Weight					
BMI, kg/m^2 (n = 487)	37.4	(12.4–83.6)	33.2	(17–73.1)	0.32
Recent weight gain	153	(23%)	9	(14%)	0.07
Amount of recent weight gain, kg (n = 136)	30	(5–150)	30	(10–100)	0.63
Treatment					
Medication	605	(92%)	59	(89%)	0.39
Diet modification	350	(53%)	30	(46%)	0.22
No. of lumbar punctures (n = 717)	1	(1–30)	1	(1–7)	0.69
CSF shunting	104	(16%)	10	(15%)	0.88
Repeat CSF shunting	45	(7%)	4	(6%)	1.00
Optic nerve sheath fenestration	97	(15%)	14	(21%)	0.17
Symptoms					
Initial symptom of IIH					
Headache	494	(75%)	36	(55%)	<0.001
Vision changes	130	(20%)	23	(35%)	0.004
Transient visual obscurations	72	(11%)	7	(11%)	0.92
Diplopia	32	(5%)	5	(8%)	0.37
Tinnitus	40	(6%)	2	(3%)	0.42
None	42	(6%)	8	(12%)	0.08
At first neuro-ophthalmology visit					
Headache	583	(89%)	52	(79%)	0.01
Transient visual obscurations	251	(38%)	18	(27%)	0.08
Diplopia	145	(22%)	16	(24%)	0.7
Tinnitus	250	(38%)	17	(26%)	0.05
Examination					
Papilledema, first visit (n = 618)	3	(0–5)	3	(0–5)	0.93
Papilledema, last visit (n = 658)	0	(0–5)	0	(0–3)	0.49
Visual field grade, first visit (n = 599)	2	(1–4)	2.8	(1–4)	0.006
Visual field grade, last visit (n = 631)	2	(1–4)	2	(1–4)	0.06
HVF MD, first visit (n = 422)	5	(0–33.5)	7.7	(1.1–33.5)	0.008
HVF MD, last visit (n = 490)	3.7	(0–33.1)	4.7	(1.1–31.2)	0.02
VA logMAR, first visit (n = 678)	0	(−0.3 to 6.9)	0.2	(−0.3 to 6.9)	<0.001
VA logMAR, last visit (n = 662)	0	(−0.3 to 6.9)	0.2	(−0.3 to 4.6)	0.002

BMI = body mass index; IIH = idiopathic intracranial hypertension; HVF MD = Humphrey visual field mean deviation; VA = visual acuity.

by prior studies,[2] but when one considers only studies applying modern neuroimaging to more than 50 IIH patients,[3,8-13] the prevalence range is 8% to 19%. This suggests that older studies may have included men with mimickers of IIH that are more difficult to diagnose without advanced neuroimaging (e.g., venous sinus thrombosis, dural arteriovenous malformations). Our study of IIH in men has the highest rate of MRI reported in the literature (>90%), making it less likely that we included patients with these conditions.

The most important finding of our study is that men were two times more likely than women to have severe visual loss in one or both eyes. Although sex has been previously suspected to be an important risk factor for visual loss in IIH, only two studies have specifically compared men vs women with IIH.[2,3] Although no significant association between male sex and visual loss in IIH has been demonstrated previously,[2,3,10,12,13] these studies were likely underpowered to find such an association, even if one was present.

Because visual loss in IIH is typically slow and insidious, the worse visual prognosis for men could be because men experience fewer nonvisual symptoms to bring them to medical attention early in the course of their disease. Indeed, men were found to report significantly less headache as both a first sign of IIH and at the initial neuro-ophthalmology visit. Instead, men were more likely to report that subjective visual changes were the heralding symptom of their illness. Men also reported less pulsatile tinnitus at initial neuro-ophthalmology evaluation, but this difference barely met our significance level and should be interpreted with caution. Further caution is warranted because higher symptom rates have been found in prospective studies and may suggest limitations in our retrospective data collection.[13,14] However, because our male and female patients were collected in a similar fashion and compared internally, there is no reason to specifically suspect bias to be the cause of the differences found. These symptom differences could suggest that IIH represents a different clinical entity in men and women. However, we believe it more likely represents a difference in headache thresholds for men and women. This is supported by several observations. First, migraine and tension-type headache are reported much more frequently by women than by men.[15,16] Second, women seem to have greater temporal summation of noxious mechanical stimuli than men do.[17] One could hypothesize from this observation that different responses to a constantly applied stimulus, such as chronically elevated intracranial pressure, may partially account for the sex headache differences in IIH. Finally, men are less likely than nonpregnant women to have post–dural puncture headaches.[18] This is particularly interesting because low-CSF-pressure and high-CSF-pressure headaches likely share a common mechanism, i.e., mechanical deformation of the meninges.

It is also possible that there were sex differences in other factors that have been previously associated with visual loss in IIH, such as degree of obesity, hypertension, recent weight gain, anemia, race, CSF opening pressure, sleep apnea, and older age.[2,8,13,19-24] Regarding obesity, one case–control study comparing 29 men with IIH to both women with IIH and normal men[2] found no differences between the men and women with IIH, but men with IIH were more obese than the age-matched control men. In another study comparing the characteristics of 18 men with IIH to 116 women with IIH,[3] men were less likely to be "significantly overweight" compared to women with IIH, but BMI was not used in the analyses. Among our 487 patients (67%) for whom BMI was available, no difference was found between the BMI of men and women with IIH. It is likely that studies that have suggested that obesity does not play a major role in the development of IIH in men were confounded by two problems: 1) inclusion of men with a different disease because of lack of adequate neuroimaging, and 2) the lack of precise anthropometric data (e.g., BMI), instead relying on weight only or the examiner's assessment of weight status.

Although some previous studies have suggested that systemic hypertension may be a poor prognostic indicator,[2,13] it was not found to be a significant factor in our study with regard to blindness. Because many of the patients in our study were treated hypertensives, this relationship may have been masked. In addition, we considered hypertension only by its presence or absence and not by a numerical value such as mean arterial pressure. This also reduces the power of finding a potentially significant relationship in this study.

We did find that men with IIH had a higher rate of diagnosed sleep apnea than women did. Epidemiologic studies have found a male-to-female ratio of sleep apnea of 5 to 8:1 in sleep clinics, whereas population-based studies have found a lower ratio of 2 to 3:1.[25] These observations suggest that although sleep apnea is likely more common in men in general, it may be underdiagnosed in women. The relationship between sleep apnea and IIH remains unclear. It is established that sleep apnea can cause nocturnal elevations in intracranial pressure that can lead to the development of papilledema.[26,27] However, there is debate about whether sleep apnea is causal or merely a comorbidity among patients whose daytime intracranial pressure remains elevated.[28-31] Because of the retrospective nature of this study, we do not know which patients underwent sleep studies but did not have sleep apnea, and thus we are unable to further address this interesting mechanistic question. Regardless, because of the possible association of sleep apnea with worse visual outcome in IIH,[19] this relationship merits further study.

Excluding our younger, prepubertal patients, we also found that men were significantly older than women with IIH by nearly a decade. This has been observed in other studies of IIH in men but did not reach significance.[2,3] The fact that there is no clear sex predilection for IIH among younger children has been observed previously.[32,33] Together, these findings suggest that IIH has a bimodal distribution in male patients, with peaks during school age and middle age.

This predilection of IIH for women in their childbearing years supports a potential role of hormonal influences in the development of this disorder. However, if hormonal influences were directly responsible for the disorder, we would expect a correlation between development and severity of disease. Instead, IIH follows a paradoxical pattern similar to that of autoimmune disease, where women are affected disproportionately but men are affected more severely.[34] Because of the retrospective nature of this study, we do not have data on several potentially pertinent aspects of our male patients (e.g., history of autoimmune disease, use of anabolic steroids, history of sterility or impotence, central vs peripheral obesity), but we believe that these factors merit further study and may lend insight into the development and course of IIH and other similar disorders.

There were no differences between our men and women with IIH with regard to recent weight gain, anemia, race, or CSF opening pressure. After accounting for the differences in sleep apnea, headache, and age discussed above, sex remained an independent risk factor for poor visual outcome in IIH, increasing the odds of severe visual loss twofold.

Finally, we considered the possibility that the worse visual outcomes among men in our study could have been related to delayed diagnosis. However, median time from first symptom onset to diagnosis of IIH was 2 weeks shorter for men compared with women. Another study of IIH in men[3] also found that men were diagnosed earlier after first symptoms than women were (14 vs 28 weeks). However, because men were more likely to have visual complaints as their first symptoms and more likely to have significant visual loss at presentation compared with women, men may have been first examined by eye care professionals more frequently. This would likely lead to the discovery of disk edema and the correct diagnosis, but after chronic papilledema had already led to visual loss. Conversely, the longer time to diagnosis for women suggests that they were treated for primary headache disorders before their disease was recognized, which emphasizes the importance of examining the ocular fundi of all patients with headache.

The main limitation of our study is its retrospective nature, which requires a prudent interpretation of our findings, especially with regard to symptoms. However, all of our patients were systematically evaluated by experienced neuro-ophthalmologists, and we have no reason to believe that our evaluations of men and women differed in such a way to introduce bias. Another limitation of the study was the treatment of visual field data using only a four-point scale. While this was able to show that visual fields were worse among men than women, it does not provide the opportunity for a more refined interpretation of the nature of these visual field differences. Although one should remain mindful of these limitations, our findings that men with IIH frequently have substantial visual impairment at presentation and may report nonvisual symptoms less often than women do suggest that men with IIH likely require more frequent monitoring and more aggressive treatment.

AUTHOR CONTRIBUTIONS

Statistical analysis was performed by B.B.B.

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